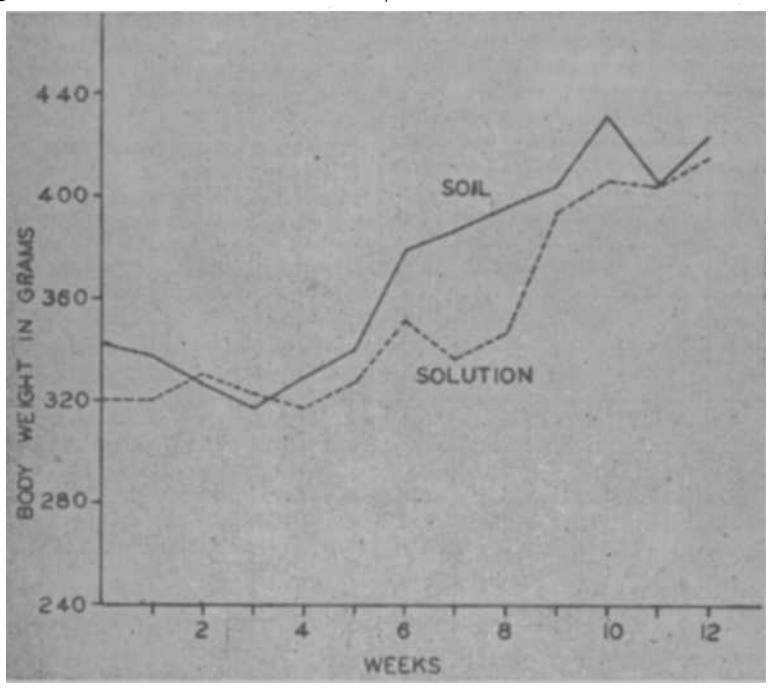
# Nutritional Value of Plants Not Lowered by Chemical Fertilization Research Reveals

Common foods grown with the aid of artificial chemical fertilizers have a nutritional quality comparable to that of foods produced in soils fertilized solely with manures or humus.

A twelve week experiment produced data indicating that plants grown in a chemical medium are neither deficient in any dietary essentials nor toxic to animals feeding on them.




Composite growth curves of guinea pigs on a sole diet of Astoria bent grass, grown in soil and in a nutrient solution.

**Guinea Pigs Used As Subjects**

Two groups of guinea pigs were used in a research study conducted by the Divisions of Plant Nutrition and Home Economics.

Each group was fed an exclusive diet of Astoria bent grass, selected by prior tests for palatability.

The first, or yardstick, group of guinea pigs was fed grass grown in soil with a known history of organic manuring.

The second group was fed grass grown in synthetic nutrient solution.

An accurate record of the growth curve of the animals served as the yardstick to measure the general dietetic adequacy in animal nutrition of plants grown without organic matter in a synthetic inorganic medium.

**Growing the Feed in Soil**

The soil plots on which the Astoria bent grass was grown by Prof. B. A. Madsen of the Agronomy Division consisted of fertile garden soil with a known fertilization history of sheep manure, alfalfa meal and barnyard manure, supplemented with commercial ammonium sulfate, calcium nitrate and ammonium phosphate.

Lead arsenate was added twice for insecticide purposes. The second application of the insecticide preceded the nutritional feeding experiment by three years.

**Growing the Feed in Chemicals**

Approximately 121 gallons of nutrient solution were used in tanks 120 inches long, 30 inches wide and eight inches deep. Forced aeration was given by two porous carbon tubes extending the length of each tank.

The nutrient solution was made with distilled water to which potassium nitrate, calcium nitrate, magnesium sulfate and ammonium phosphate were added.

A supplementary solution furnished boron, manganese, zinc, copper and molybdenum. Iron was added as the plants grew large.

The solution was analyzed from time to time and the chemical nutrients replenished as used.

**Feeding Experiment**

The grass was clipped twice a week and the clippings fed as the sole food to the animals directly or kept for several days in a refrigerator.

At the start of the feeding experiment, each guinea pig was given 100 grams of the grass daily. Later, the clippings were supplied for free-feeding and each animal often ate more than 300 grams daily.

**Conclusions**

At the end of the twelve week feeding period, the guinea pigs in both groups showed good growth in length, excellent skeletal and muscular development, good condition of fur, clear eyes and all the other indications of nutritional well-being.

The growth date recorded indicated no superiority in the nutritional quality of grass produced in soil over that produced in an artificial inorganic medium without soil. Such fluctuations in the growth as were observed are probably within the limits of variability among the animals.

The results of the feeding experiment gave no indication of any toxicity in the grass grown by the water method.

No evidence was found that plants grown in a chemical medium are deficient in any dietary essentials.

*The experiment reported above was conducted co-operatively by Agnes Fay Morgan, Professor of Home Economics and Biochemist in the Experiment Station; Daniel I. Arnon, Associate Professor of Plant Nutrition and Associate Plant Physiologist in the Experiment Station; and Helen D. Simms, formerly research assistant in Home Economics.*

# 2,4-D Valuable As Weed Killer But Can Be Detrimental

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again as soon as it is large enough.

2) There is a definite soil sterilization from the use of 2,4-D as a weed-killer. How long the effect will last and how serious it will be under particular field conditions will depend on soil type, temperature, moisture and the succeeding crop.

3) Any sprayer or other equipment in which the chemical has been used should be thoroughly washed out before being used to spray other materials on field, orchard, or ornamental plants. Rinsing with a little cold water is not sufficient. The sprayer should be thoroughly washed out with several changes of water to which a little baking soda or washing soda has been added. The use of warm water is also advantageous.

4) In spraying lawns or other areas of weeds, it is important that no spray is allowed to reach nearby ornamental or crop plants. Even small amounts of the spray drifting from the nozzle may be sufficient to injure these plants, some of which are quite sensitive.

**Commercial Products Available**

At present there are available on the market over 60 commercial products containing 2,4-D which are registered with the Bureau of Chemistry, State Department of Agriculture.

*W. A. Harvey is Associate in Botany and Associate in the Experiment Station, Davis.*

The biology and the utilization of California browse plants are under study.

# Seek Answers to Nitrogen Needs of Orchards

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A question closely related to the one of timing is the effect of applications late in the growth cycle of the fruit on the resultant size. Experiments with cherries, peaches, apricots and prunes over a period of several years failed to show any benefit in larger fruit from such applications.

**Rate of Use**

Methods of determining the most satisfactory rate of use are under study at the present time.

The maximum rate that can be used without damage, and the most economical rate for a given set of conditions are points of information that are much more complicated than some of the questions studied earlier.

**Research Continues**

Considerations such as pruning method, temperature and light intensity in a district, soil depth and texture, and soil management influence the utilization of nitrogen.

As the work on nitrogen progresses, the problems become more complex and the desirability of developing shortcuts to the answers becomes greater. To find such quick methods becomes a major objective.

A program of field experimentation supplemented by laboratory and greenhouse research is being followed to provide more insight into fruit tree behavior and to form a basis for answers to growers' problems such as those indicated.

*E. L. Proebsting, is Professor of Pomology and Pomologist in the Experiment Station, Davis.*

# Steamed Cull Limas Palatable Protein Source for Hogs

**E. H. Hughes**

Tons of cull and damaged beans are fed annually to livestock in the United States.

Most beans are cooked when fed to hogs because they are more palatable and are more completely utilized. The pig does not like raw beans because of the bitter taste, which disappears during the cooking process.

Steaming requires much less labor than boiling in open kettles and the final product is just as valuable.

Illustrating the method used in removing the beans from the cooker. Note the steam pipe disconnected.

Steaming has an additional value in that the beans may be processed, sacked and fed at any time of the year.

**Experiment With Lima Beans**

A quantity of cull lima beans was purchased for experimental purposes. The average percentage composition of several samples of cull lima beans was: moisture, 11.7; ash, 4.4; protein, 19.7; fat, 1.2; starch, sugar, etc., 57.8; and crude fiber, 5.0.

The pigs used in the experiment were good feeders with the initial weight of 52 pounds and were fed until they weighed about 200 pounds. They were kept on concrete floors, fed and watered in steel troughs and had access to inside and outside pens.

All mature beans are deficient in vitamin A and like barley, their lime content is low, therefore, in the experiment, four lots of pigs were fed steamed lima beans, rolled barley, tankage, alfalfa meal, salt and oyster shell flour.

In the first of two groups 15% lima beans were fed but the tankage was varied from five per cent in lot one to 2.5% in lot two.

In the other pens 30% steamed limas were included and the tankage varied as in groups one and two.

The beans were fed in one trough and the rest of the ration fed in a separate one.

The average daily gains were similar for all lots and the feed required for 100 pounds of gain were not materially different.

**Results**

It appeared from this study that steamed limas could be fed successfully at either a 15% or a 30% level. It demonstrated further that 2.5% tankage in these rations was just as efficient as five per cent.

When the experiment was concluded, the hogs were slaughtered and examined. The carcasses were excellent and there was no apparent difference in the quality of the carcasses of the various lots.

Rations containing rolled barley, steamed beans, alfalfa meal, salt and oyster shell flour and a small amount of tankage resulted in economical gains, growth and fattening.

**How the Beans Were Steamed**

Enough beans for one day's feeding were weighed and placed in a clean garbage can, then a known amount of water was added, enough to cover the beans. They were allowed to soak over night.

In the morning they were placed in a round container which had a steam pipe connected through the center of the container into the true bottom. A false bottom filled with small holes was set about 10 inches above the true bottom, which permitted the steam to filter upwards through the beans.

With the cover of the container in place the beans were steamed for 20 minutes. The steam was then turned off and the beans allowed to self cook until the afternoon when they were removed.

The beans were allowed to cool before they were fed that evening and the next morning.

*E. H. Hughes, is Professor of Animal Husbandry and Animal Husbandman in the Experiment Station, Davis.*

# Control of Coddling Moth With DDT Spray on Apples and Pears Good in Investigational Work

**Arthur D. Borden**

During the past three seasons of investigational work with DDT for the control of codling moth on apples and pears the results have been excellent.

It has proved so much more efficient than lead arsenate that its use during the coming season is generally recommended on apples and pears. There has been no apparent injury to fruit or foliage except when used in combinations with oil emulsions or when the DDT was dissolved in oil.

The outstanding advantage in the use of DDT is that good codling moth control with this material has been obtained with the use of not over three applications of DDT where from five to seven applications of lead arsenate have been required.

As few as two thorough applications of DDT in the early season have practically stopped the flight and eliminated the damage of the first brood of codling moth. A third application at a reduced dosage has stopped second-brood attacks on late varieties of fruit. This reduction in materials and in the cost of applying sprays, combined with the more efficient control of codling moth, will mean much to the apple and pear growers in California.

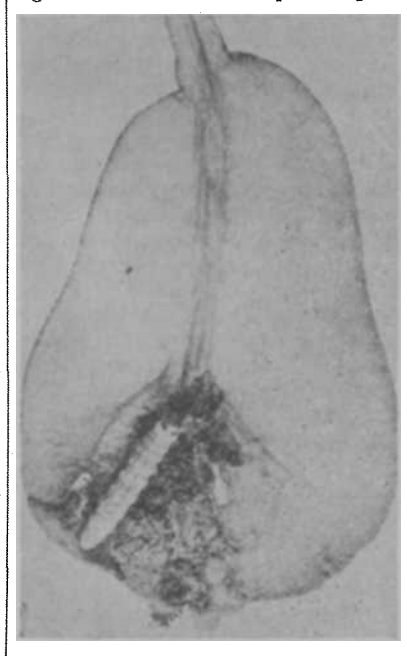
**Timing of DDT Applications**

It has been found that it is not necessary to attempt to fill the calyx cups with DDT as has been the practice with lead arsenate. Instead of starting to spray with DDT when 50 to 75 per cent of the petals are off—as has been the practice for years with lead arsenate—the first application should not be made until 90 per cent or practically all of the petals have fallen. There has been some evidence that DDT sprayed in the blossoms has prevented the natural setting of fruit.

The second application should be started 15 to 17 days after the beginning of the first spray. The third application, if required on early harvested varieties, should be applied at least three weeks before harvest. On late varieties of pears and applies this application should be made in late June or early in July at the first appearance of the second brood of moths.

**Materials and Dosages Recommended**

The fifty per cent wettable DDT powder, as used during the past season, is apparently the safest and the most economical formulation to use on pears and apples. The addition of a small amount of powdered spreader such as four ounces of Multifilm or eight ounces of DDT Depositor plus from one pint to one quart of kerosene will increase the deposit of DDT on the fruit.



Fully grown codling moth larva in a pear.

No spreader containing spray oil or any type of spray oil emulsion should be used with DDT as leaf injury and even defoliation may occur.

The addition of lead arsenate to the following DDT spray formulas is not necessary but if for any reason it is desired to use lead arsenate either in a split program or in combination with DDT the 1946 spray program may be followed.

Small amounts of so-called soluble copper compounds, bordeau mixture, or sulfur may be added to the early DDT sprays for the control of scab, mildew, and the prevention of fireblight if necessary.

In the first two applications—delayed calyx and first cover spray—the following dosages are recommended:

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| 50 per cent DDT wettable powder | 1½ to 2* lbs. |
| Dry spreader or deposit builder | 4 to 8 oz. |
| Kerosene | 1 pt. to 1 qt. |
| Water | 100 gals. |

In the late cover spray:

| | |
|---|---|
| 50 per cent DDT wettable powder | 1 to 1½* lbs. |
| Dry spreader or deposit builder | 4 to 8 oz. |
| Water | 100 gals. |

*The higher dosages to be used where infestations are serious.

**Cautions**

In this late spray the addition of a miticide such as DN-111 or xanthone to control the brown mite, two-spotted mite, and European red mite may be added to the DDT formula. Dosages of these miticides should follow the manufacturer's recommendations. Kerosene or oil emulsions should not be used with DN-111. Kerosene—up to one quart per 100 gallons of spray—may be added to the DDT-xanthone combination, but no oil emulsions should be used with xanthone. Oil emulsions for the control of mites should not be combined with DDT or used within three weeks of the last DDT application.

On apples the woolly apple aphid may become a serious pest following the use of DDT. Timely applications of an aphicide, such as nicotine or

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